

Segmentation Gap-Filled Product Development

Segmentation Algorithm Selection

The original development of the segmentation gap-filled product was done using the commercial eCognition package, which is a standard tool available to research scientists at USGS/EROS. During the development phase a significant amount of effort was invested in tuning the eCognition segmentation parameters to work well in this application. Though all of the prototype product generation and algorithm development work was done using eCognition, this package has several disadvantages from the standpoint of implementation in a production system. These disadvantages include:

1. eCognition runs in a Microsoft Windows environment, unlike the Landsat 7 production systems which all use the Linux operating system.
2. The “Professional” (single analyst) version of the eCognition product requires an analyst to load individual images and initiate a protocol to control the segmentation process. The “Enterprise” edition of the software is available which provides more automation.
3. Processing a full Landsat scene taxes the resources, particularly memory, of a typical desktop workstation and requires significant processing time (1-3 hours for a full scene). The Enterprise edition also improves performance, taking 24 minutes to process a scene using a single processor and only 9 minutes with parallel processing.

Although the Enterprise edition of eCognition overcame the operational problems associated with level of automation and throughput (though not the need to maintain a separate Windows platform for the segmentation processing), the cost of this product is high (\$60K-\$80K). This motivated a search for alternate methods of performing the segmentation processing. The requirements for image size, throughput, and multi-scale segmentation that this application places on the segmentation engine limit the available choices.

Dr. James Tilton at NASA GSFC has developed a segmentation package that runs in a Linux environment and, though a commercial implementation does exist (see <http://www.fuentek.com/technologies/rhseg.htm>), would be available to a U.S. government user at little or no cost. To see whether this RHSEG package would yield segmentation results comparable to eCognition a subset of a scene was provided to Dr. Tilton for testing. By tuning the application-specific RHSEG parameters Dr. Tilton was able to closely match the reference eCognition results, though it was unclear how well these parameter settings would hold up over a broader selection of input data. Further, RHSEG was able to process a full scene in less than 8 minutes. However, it required the 256-node GSFC Beowulf cluster to achieve this performance. Processing time on a single CPU would be measured in hours. It was also noted that substantial additional engineering work would be required to achieve the desired level of automation in the processing flow using RHSEG. Due to these throughput and integration/automation concerns, RHSEG was rejected as a viable alternative for segmentation processing.